Woodsy Owl wants children to understand what scientists are discovering. Let's meet Dr. Marcus Warwell!

USDA Forest Service photo courtesy of Marcus Warwell.

As a kid, Dr. Warwell was curious about the world.

This is Marcus Warwell with his dog Egypt when he was young.

In college, Dr. Warwell became curious about seeds. He wanted to know how and why seeds grow.

These are pine cones. Pine tree seeds are inside the pine cones.

Now, Dr. Warwell is a scientist who grows, collects, and studies seeds.

Dr. Warwell looks at ponderosa pine **seedlings** as they grow. Ponderosa pine trees are tall trees. One place they grow is in the Western United States.

Seeds need water to grow.

Adobe Stock, photo by Sukjai Photo.

This child waters seeds that have been planted in pots.

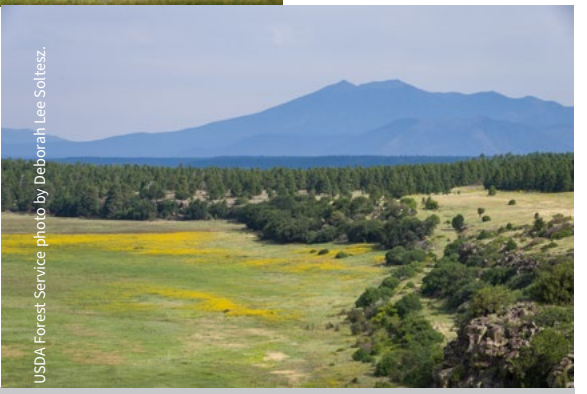
Seeds can get water from rain or melting snow. Sometimes, the place where seeds grow gets less water or snow than normal. This place may be in a **drought**.

These seeds have sprouted into plants. The rain will help them grow.

A drought is when there is not enough rain or snow over a long period of time. A drought can last for months or even years!

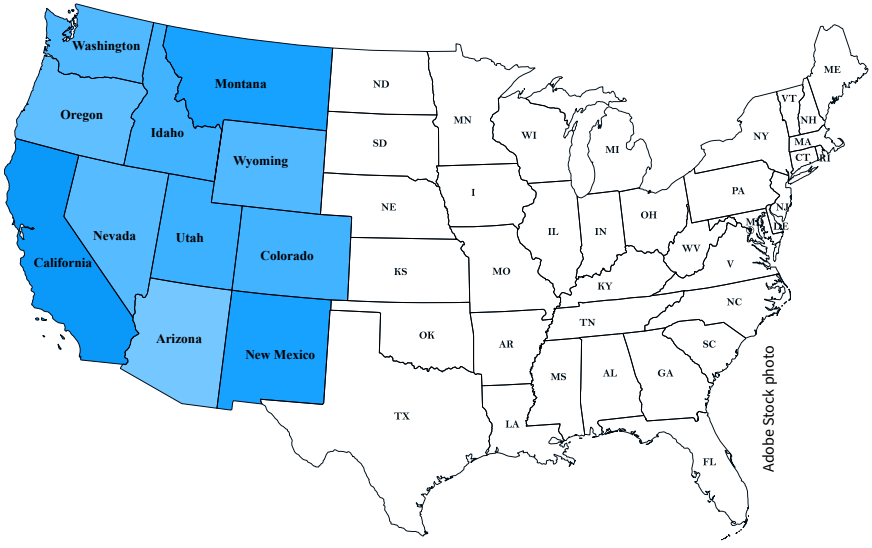
These sugar beets are growing in a drought. What do you notice about their leaves and stems?

When there is not enough rain or snow in an area, there is less water for humans, animals, and plants to use.



During a drought, rivers and lakes have less water in them or dry up entirely. On the top is a lake that sometimes has **shallow** water that animals come to drink. On the bottom is the lake during a drought. You can see the water has dried up. The animals will move to another place to find water.

Some areas of the United States, especially in the Western United States where Dr. Warwell worked, have not had enough rain and snow in the last few years.



This map shows the Western United States.

As a scientist, Dr. Warwell likes to ask questions. He asked, "How do seeds from different places grow when there is a drought?"

What area of this picture do you think gets the most water? How do you know?

Dr. Warwell worked with other scientists to answer his question.

Scientists plant ponderosa pine seeds in neat rows. They will study how these seeds grow differently from each other.

They gave some seeds water every week through the spring and summer. They also gave some seeds no water after late spring and other seeds no water after the middle of summer. It rains very little where they planted the seeds, so getting no water during the spring or summer is like what happens to plants during a drought.

Dr. Warwell makes careful **observations** as the seeds grow into young trees.

They compared how all these seeds grew. Dr. Warwell used **calipers**, a measuring tool, to measure how big the plants grew.

Photo courtesy of Marcus Warwell.

These are calipers. The tips of the calipers open to measure how big a plant is. These calipers can send the measurements to a computer that Dr. Warwell used.

Dr. Warwell saw differences among the plants.

This ponderosa tree seedling has begun to sprout from its seed.

One thing Dr. Warwell learned is that more seedlings survived a late-summer drought.

Which seedlings in this photo have died? How do you know?

Dr. Warwell thought about why more seedlings might survive a late-summer drought. Dr. Warwell thought about the seeds that the seedlings grew from. These seeds came from trees that grew in places that often had droughts later in the summer.

These are older ponderosa pine trees. Ponderosa pine trees can grow in places that do not get a lot of rain.

Dr. Warwell and other scientists can use this information to pick seeds to grow in forests that may have droughts.

A Forest Service worker plants a new tree seedling in a forest.

People who care for forests may plant new trees in forests. Dr. Warwell's research will help people to care for forests in the future.

USDA Forest Service photo by Rachel W. deLeon

This Forest Service worker plants a young ponderosa pine.

Critical Thinking Questions:

- Dr. Warwell is curious about seeds. What is something that you are curious about?

- Many places experience drought. With the help of your teacher, find out if your **community** is in a drought right now. What are some rules that communities make when they are in a drought?

- Why is a drought harmful? Think about things or activities that need water. How would these be different if there was less water?

Glossary:

calipers (**ka** lə pərs): a measuring tool with two legs that can be moved to measure how big or thick something is

community (kə **myü** nə tē): the people living in an area; also the area itself

drought (**draut**): a long period of dry weather

observation (äb sər **vā** shən): seeing and taking notes on a fact or something that happens, usually using measurement tools

seedling (**sēd** liŋ): a young plant grown from a seed

shallow (**sha** lō): not deep